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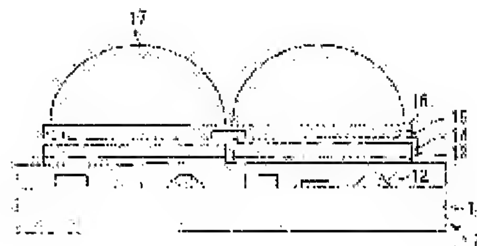
(54) ORGANIC ELECTROLUMINESCENT DEVICE, MANUFACTURING METHOD OF ORGANIC ELECTROLUMINESCENT DEVICE AND ELECTRONIC APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an organic electroluminescent device which of efficiently utilizes light emitted from an organic EL element, and also to provide a manufacturing device of the organic electroluminescent device, and an electronic apparatus.
SOLUTION: This organic EL device 1 is composed by forming, on a substrate 11, an organic electroluminescent element having an organic EL film 14 of a luminescent layer between a negative electrode 13 and a positive electrode 15. This organic EL device is characterized by forming a microlens array 17 on the luminescent surface side of the organic electroluminescent element.



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[Claim(s)]

[Claim 1]

In an organic electroluminescence device with which an organic electroluminescence element which has a luminous layer in inter-electrode [two] was formed on a substrate, An organic electroluminescence device providing a micro lens array in the light-emitting surface side of said organic electroluminescence element.

[Claim 2]

Two or more said organic electroluminescence elements are provided as what makes a pixel, The organic electroluminescence device according to claim 1, wherein each lens of said micro lens array is arranged for said every organic electroluminescence element.

[Claim 3]

Two or more said organic electroluminescence elements are provided as what makes a pixel, The organic electroluminescence device according to claim 1 characterized by arranging said micro lens array so that said one organic electroluminescence element may correspond every two or more lenses in said micro lens array.

[Claim 4]

Two or more said organic electroluminescence elements are provided as what makes a pixel, The organic electroluminescence device according to claim 1 characterized by arranging said micro lens array so that said two or more organic electroluminescence elements may correspond for every lens in said micro lens array.

[Claim 5]

The organic electroluminescence device according to any one of claims 1 to 4 having a means to drive said luminous layer actively.

[Claim 6]

The organic electroluminescence device according to any one of claims 1 to 5, wherein said

micro lens array is provided in the upper surface side of an organic electroluminescence element formed on said substrate.

[Claim 7]

The organic electroluminescence device according to any one of claims 1 to 6, wherein said micro lens array is formed by transparent resin which has optical hardenability.

[Claim 8]

So that it may be emitted to the exterior of said organic electroluminescence device, after it is the light emitted from said luminous layer, and light which saw from this luminous layer and was emitted to a reverse side with said substrate side penetrates said micro lens array at least, The organic electroluminescence device according to any one of claims 1 to 7, wherein this luminous layer and a micro lens array are arranged.

[Claim 9]

The organic electroluminescence device according to any one of claims 1 to 8, wherein said micro lens array consists of a member with a refractive index of 1.54 or more.

[Claim 10]

The organic electroluminescence device according to any one of claims 1 to 5, wherein said micro lens array is formed in an inside of said substrate.

[Claim 11]

So that it may be emitted to the exterior of said organic electroluminescence device, after it is the light emitted from said luminous layer, and light which saw from this luminous layer and was emitted to said substrate side penetrates said micro lens array and this substrate at least, The organic electroluminescence device according to claim 10, wherein this luminous layer and a micro lens array are arranged.

[Claim 12]

The organic electroluminescence device according to claim 10 or 11, wherein said micro lens array consists of two or more Fresnel's lenses.

[Claim 13]

The organic electroluminescence device according to claim 12 after said substrate's forming said two or more Fresnel's lenses, wherein it provides and makes an interlayer insulation film flat on this Fresnel's lens.

[Claim 14]

The organic electroluminescence device according to claim 13, wherein said organic electroluminescence element is provided in the upper surface of said interlayer insulation film at least.

[Claim 15]

In a manufacturing method of an organic electroluminescence device with which an organic electroluminescence element which has a luminous layer in inter-electrode [two] was formed

on a substrate,
A manufacturing method of an organic electroluminescence device characterized by forming a micro lens array on this organic electroluminescence element after forming said organic electroluminescence element on said substrate.
[Claim 16]
A manufacturing method of the organic electroluminescence device according to claim 15 forming said micro lens array using transparent resin which has optical hardenability.
[Claim 17]
After forming said organic electroluminescence element on said substrate, an oxidization nitriding silicone film is formed in the surface of this organic electroluminescence element,
Said resin is applied to the surface of this oxidization nitriding silicone film,
A model of said micro lens array is stuck to this resin, and this resin is stiffened by irradiating this resin,
A manufacturing method of an organic electroluminescence device forming said micro lens by separating a model of said micro lens from said resin.
[Claim 18]
In a manufacturing method of an organic electroluminescence device with which an organic electroluminescence element which has a luminous layer in inter-electrode [two] was formed on a substrate,
A manufacturing method of an organic electroluminescence device characterized by forming said organic electroluminescence element on this board after forming a micro lens array in an inside of said substrate.
[Claim 19]
After forming said micro lens array, it becomes flat with an interlayer insulation film about a part of this micro lens array, A manufacturing method of the organic electroluminescence device according to claim 18 forming said organic electroluminescence element at least on this interlayer insulation film.
[Claim 20]
An oxidization nitriding silicone film is formed in said substrate,
A manufacturing method of the organic electroluminescence device according to claim 18 or 19 forming said Fresnel's lens in said oxidization nitriding silicone film by photo lithography and reactant ion etching.
[Claim 21]
A manufacturing method of the organic electroluminescence device according to claim 20 with which, as for said oxidization nitriding silicone film, a composition ratio of oxygen and nitrogen is characterized by oxygen being 80% from 40% by an atomic percentage ratio.
[Claim 22]

In a manufacturing method of an organic electroluminescence device with which an organic electroluminescence element which has a luminous layer in inter-electrode [two] was formed on a substrate,
Said organic electroluminescence element is formed on said substrate,
This organic electroluminescence element is closed,
It grinds or grinds to thickness of a request of said substrate,
A manufacturing method of an organic electroluminescence device pasting together a micro lens array board which formed a lens according to a position of said organic electroluminescence element to said substrate ground or ground.
[Claim 23]
A manufacturing method of the organic electroluminescence device according to claim 22 performing pasting to said micro lens array and said substrate ground or ground using transparent resin which has optical hardenability.
[Claim 24]
A manufacturing method of the organic electroluminescence device according to claim 23 with which said resin is characterized by a refractive index being 1.54 or more.
[Claim 25]
Electronic equipment provided with the organic electroluminescence device according to any one of claims 1 to 14.
[Claim 26]
Electronic equipment provided with an organic electroluminescence device manufactured with the manufacturing method according to any one of claims 15 to 24.

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to the manufacturing method and electronic equipment of an organic electroluminescence device and an organic electroluminescence device.
[0002]
[Description of the Prior Art]
Conventionally, two or more organic materials and electrode materials used as a pixel were formed in order by vapor deposition etc. on the glass substrate in which the electrode and the drive circuit were provided, and the active organic electroluminescence device which provided the organic electroluminescence (henceforth EL) element was manufactured. Drawing 8 is an outline sectional view showing an example of the conventional organic electroluminescence

device. Drawing 8 (a) makes light emit from the bottom side of the substrate 81, namely, is a substrate side luminescence type organic electroluminescence device using the light which penetrated the substrate 81. Drawing 8 (b) makes light emit from the upper surface side of the substrate 91, namely, is a closure side luminescence type organic electroluminescence device made to emit light from the organic electroluminescence layer 94 side of the substrate 91.

[0003]

The organic electroluminescence device shown in drawing 8 (a) has the composition of having formed the transparent anode 83 on the transparent substrate 81, having formed the organic electroluminescence film 84 which is a luminous layer on the anode 83, and having formed the negative pole 85 on the organic electroluminescence film 84. The light emitted from the organic electroluminescence film 84 penetrates the anode 83 and the substrate 81, emits them out of an organic electroluminescence device, and is caught by man's eyes.

[0004]

The organic electroluminescence device shown in drawing 8 (b) has the composition of having formed the negative pole 93 on the substrate 91, having formed the organic electroluminescence film 94 on the negative pole 93, having formed the transparent anode 95 on the organic electroluminescence film 94, and having formed the transparent protective film 96 on the anode 95. The light emitted from the organic electroluminescence film 94 penetrates the anode 95 and the protective film 96, emits them out of an organic electroluminescence device, and is caught by man's eyes.

For every trichromatic color, using the mask vapor-depositing method, selection vapor deposition of the request material was carried out, and it was manufactured in the organic electroluminescence device which performs a full color display.

[0005]

[Problem to be solved by the invention]

However, in the conventional organic electroluminescence device, since light was emitted in all directions from the organic electroluminescence film, it was reflected on the boundary of the substrate and exterior air, or the protective film of an organic electroluminescence device and the boundary of exterior air, and the light aslant emitted to the substrate side had the problem of not being emitted out of an organic electroluminescence device. And what serves as loss light without emitting the above-mentioned reflection out of an organic electroluminescence device among the lights emitted from the organic EL device had reached also to 70% from 60%.

[0006]

In the conventional organic electroluminescence device, in order to obtain desired luminosity, the method of increasing the current which increases the voltage impressed to an electrode and flows through an organic EL device was used. However, in this method, while

consumption current increased, there was a problem that the life of an organic EL device became short.

[0007]

This invention was made in view of the situation mentioned above, and aims at offer of the manufacturing method of an organic electroluminescence device and an organic electroluminescence device, and electronic equipment which can use efficiently the light emitted from the organic EL device.

[0008]

[Means for solving problem]

In order to attain the above-mentioned purpose, [the organic electroluminescence device of this invention] In the organic electroluminescence device formed on the substrate, the organic electroluminescence element which has a luminous layer in inter-electrode [two] provided the micro lens array in the light-emitting surface side of said organic electroluminescence element.

According to such an invention, after the light emitted from the luminous layer is condensed by the micro lens array, it is emitted out of an organic electroluminescence device. That is, among the lights emitted from the luminous layer, with the lens of a micro lens array, the light aslant emitted to the substrate side is also perpendicularly refracted to a substrate side, and is emitted to the exterior of a device. therefore, the light emitted from the luminous layer -- all can be made to be almost able to emit out of an organic electroluminescence device, and the light can be made to reach to a naked eye Then, this invention can use efficiently the light emitted from the organic EL device.

[0009]

Two or more organic electroluminescence devices of this invention are formed as that in which said organic electroluminescence element makes a pixel, and, as for each lens of said micro lens array, it is preferred to be arranged for said every organic electroluminescence element. According to such an invention, since the light emitted from two or more organic EL devices which make a pixel is emitted to the exterior of a device after being condensed with each lens of a micro lens array, respectively, the luminous efficiency in the organic electroluminescence device which has two or more pixels can be raised sharply.

[0010]

[the organic electroluminescence device of this invention] The composition that said micro lens array is arranged may be used so that two or more said organic electroluminescence elements may be provided as what makes a pixel and said one organic electroluminescence element may correspond every two or more lenses in said micro lens array.

[0011]

[the organic electroluminescence device of this invention] The composition that said micro

lens array is arranged may be used so that two or more said organic electroluminescence elements may be provided as what makes a pixel and said two or more organic electroluminescence elements may correspond for every lens in said micro lens array.

[0012]

As for the organic electroluminescence device of this invention, it is preferred to have a means to drive said luminous layer actively.

[0013]

As for the organic electroluminescence device of this invention, it is preferred that said micro lens array is provided in the upper surface side of the organic electroluminescence element formed on said substrate.

According to such an invention, the luminous efficiency in the closure side luminescence type organic electroluminescence device made to emit light from the upper surface side of a substrate (light is made to emit from the organic electroluminescence layer side of a substrate) can be raised sharply.

[0014]

As for the organic electroluminescence device of this invention, it is preferred that said micro lens array is formed by the transparent resin which has optical hardenability.

According to such an invention, a request-shaped micro lens array can be formed easily.

[0015]

[the organic electroluminescence device of this invention] So that it may be emitted to the exterior of said organic electroluminescence device, after it is the light emitted from said luminous layer, and the light which saw from this luminous layer and was emitted to the reverse side with said substrate side penetrates said micro lens array at least, It is preferred that this luminous layer and the micro lens array are arranged.

the light which according to such an invention was emitted out of the organic electroluminescence device and emitted from the luminous layer by ** after the micro lens array condensed the light emitted from the luminous layer -- all can be made to be almost able to emit out of an organic electroluminescence device, and the light can be made to reach to a naked eye

[0016]

As for the organic electroluminescence device of this invention, it is preferred that said micro lens array consists of a member with the refractive index of 1.54 or more.

According to such an invention, while being able to raise luminous efficiency more, a micro lens array is miniaturizable.

[0017]

As for the organic electroluminescence device of this invention, it is preferred that said micro lens array is formed in the inside of said substrate.

According to such an invention, miniaturization of an organic electroluminescence device can be attained, raising the luminous efficiency of an organic electroluminescence device.
[0018]
[the organic electroluminescence device of this invention] So that it may be emitted to the exterior of said organic electroluminescence device, after it is the light emitted from said luminous layer, and the light which saw from this luminous layer and was emitted to said substrate side penetrates said micro lens array and this substrate at least, It is preferred that this luminous layer and the micro lens array are arranged.
[0019]
As for the organic electroluminescence device of this invention, it is preferred that said micro lens array consists of two or more Fresnel's lenses.
According to such an invention, the formation process of a micro lens array becomes simple, and reduction of a manufacturing cost and shortening of production time can be attained.
[0020]
As for the organic electroluminescence device of this invention, it is preferred that said substrate provides and makes an interlayer insulation film flat on this Fresnel's lens after forming said two or more Fresnel's lenses.
According to such an invention, it becomes possible to form an organic EL device, wiring, etc. easily on Fresnel's lens (micro lens array).
[0021]
As for the organic electroluminescence device of this invention, it is preferred that said organic electroluminescence element is provided in the upper surface of said interlayer insulation film at least.
[0022]
[the manufacturing method of the organic electroluminescence device of this invention] In the manufacturing method of the organic electroluminescence device with which the organic electroluminescence element which has a luminous layer in inter-electrode [two] was formed on the substrate, After forming said organic electroluminescence element on said substrate, a micro lens array is formed on this organic electroluminescence element.
According to such an invention, since the organic electroluminescence device concerning this invention can be manufactured by pasting up a micro lens array on this organic electroluminescence device after manufacturing an organic electroluminescence device with the manufacturing method of the conventional organic electroluminescence device, it becomes possible to use the conventional manufacture device etc. effectively.
[0023]
As for the manufacturing method of the organic electroluminescence device of this invention, it is preferred that said micro lens array forms using the transparent resin which has optical

hardenability.
According to such an invention, it becomes simply realizable to manufacture a micro lens array in desired shape.
[0024]
[the manufacturing method of the organic electroluminescence device of this invention] After forming said organic electroluminescence element on said substrate, An oxidization nitriding silicone film is formed in the surface of this organic electroluminescence element, Said micro lens is formed by applying said resin to the surface of this oxidization nitriding silicone film, sticking the model of said micro lens array to this resin, stiffening this resin by irradiating this resin, and separating the model of said micro lens from said resin.
According to such an invention, it can manufacture at low cost simply [luminous efficiency is high and / device / long lasting / organic electroluminescence] by low consumption current.
[0025]
[the manufacturing method of the organic electroluminescence device of this invention] In the manufacturing method of the organic electroluminescence device with which the organic electroluminescence element which has a luminous layer in inter-electrode [two] was formed on the substrate, After forming a micro lens array in the inside of said substrate, said organic electroluminescence element is formed on this substrate.
According to such an invention, it can manufacture at low cost by low consumption current simply [though it is compact, luminous efficiency is high, and / device / long lasting / organic electroluminescence].
[0026]
[the manufacturing method of the organic electroluminescence device of this invention] After forming said micro lens array, it is preferred to become flat with an interlayer insulation film about the part of this micro lens array, and to form said organic electroluminescence element at least on this interlayer insulation film.
According to such an invention, it can manufacture at low cost by low consumption current simply [though it is compact, luminous efficiency is high, and / device / long lasting / organic electroluminescence].
[0027]
As for the manufacturing method of the organic electroluminescence device of this invention, it is preferred to form an oxidization nitriding silicone film in said substrate, and to form said Fresnel's lens in said oxidization nitriding silicone film by photo lithography and reactant ion etching.
According to such an invention, though it is compact, luminous efficiency is high, and a long lasting organic electroluminescence device can be manufactured simply quickly by low cost with low consumption current.

[0028]
As for the manufacturing method of the organic electroluminescence device of this invention, it is [said oxidization nitriding silicone film] preferred that the composition ratio of oxygen and nitrogen is [oxygen] 80% from 40% in an atomic percentage ratio.
[thus having specified the composition ratio of oxygen and nitrogen in said oxidization nitriding silicone film] [the oxygen concentration of this (from 40% to 80%) more than] It is because transmissivity will fall rapidly if a refractive index becomes low, and performance of a micro lens array cannot be demonstrated and oxygen concentration is lowered more, so it will be a dark organic electroluminescence device which does not let the light emitted from the organic electroluminescence layer pass.
[0029]
[the manufacturing method of the organic electroluminescence device of this invention] In the manufacturing method of the organic electroluminescence device with which the organic electroluminescence element which has a luminous layer in inter-electrode [two] was formed on the substrate, Form said organic electroluminescence element on said substrate, and this organic electroluminescence element is closed, It grinds or grinds to the thickness of a request of said substrate, and the micro lens array board which formed the lens according to the position of said organic electroluminescence element is pasted together to said substrate ground or ground.
According to such an invention, the manufacturing method of the conventional organic electroluminescence device can be used effectively.
[0030]
As for pasting to said micro lens array and said substrate ground or ground, it is [the manufacturing method of the organic electroluminescence device of this invention] preferred to carry out using the transparent resin which has optical hardenability.
[0031]
As for the manufacturing method of the organic electroluminescence device of this invention, it is preferred that said resin is [a refractive index] 1.54 or more.
According to such an invention, while being able to raise luminous efficiency more, an organic electroluminescence device can be manufactured simply.
[0032]
The electronic equipment of this invention was provided with said organic electroluminescence device.
According to this invention, luminous efficiency is high, is low consumption current, and electronic equipment provided with the long lasting and compact displaying means can be simply provided at low cost.
[0033]

The electronic equipment of this invention was provided with the organic electroluminescence manufactured with the manufacturing method of said organic electroluminescence device. According to this invention, luminous efficiency is high, is low consumption current, and electronic equipment provided with the long lasting and compact displaying means can be simply provided at low cost.

[0034]

[Mode for carrying out the invention]

Hereafter, the organic electroluminescence device concerning the embodiment of this invention is explained with reference to Drawings.

[0035]

(A 1st embodiment)

Drawing 1 is an outline sectional view showing the organic electroluminescence device concerning a 1st embodiment of this invention. This organic electroluminescence device 1 is a closure board luminescence type organic electroluminescence device which emits light toward the outside (Drawings upper part) from the surface of the substrate 11.

[0036]

This organic electroluminescence device 1 is provided with the following.

Substrate 11.

The negative pole 13 provided on the substrate 11.

The organic electroluminescence film 14 provided on the negative pole 13.

The transparent anode (ITO) 15 provided on the organic electroluminescence film 14.

The organic EL device consists of the negative pole 13, the organic electroluminescence film 14, and the anode 15. On the substrate 11, two or more negative poles 13 and organic electroluminescence films 14 are formed, and are making the pixel, respectively. The transistor 12 which drives an organic EL device actively is formed in the substrate 11. The protective film 16 is formed on the anode 15.

[0037]

In this organic electroluminescence device 1, the micro lens array 17 is formed in the protective film 16 top, i.e., the organic EL device upper part. Each lens of the micro lens array 17 is arranged at every [of an organic EL device] pixel (the negative pole 13 and organic electroluminescence film 14). Arrangement with each lens of this micro lens array 17 and the pixel of an organic EL device is good also as that by which the pixel of one organic EL device is arranged for two or more lenses of every which can be set not only to the composition shown in drawing 1 but to the micro lens array 17. It is good also as that by which the pixel of two or more organic EL devices is arranged for every lens in the micro lens array 17.

[0038]

As for the micro lens array 17, it is preferred to be formed by the resin which has transparent

optical hardenability. As for the micro lens array 17, it is preferred to consist of a member with the refractive index of 1.54 or more. Although the closure board (not shown) for closing an organic EL device may be provided above the micro lens array 17, the function as a closure board may be given to the micro lens array 17 or the protective film 16, without providing the closure board in particular.

[0039]

The light emitted more to these composition from the organic electroluminescence film 14 is penetrated from the transparent anode 15, penetrates the protective film 16 transparent subsequently, subsequently penetrates the convex lens of the micro lens array 17, and emits it out of the organic electroluminescence device 1. Here, among the lights emitted from the organic electroluminescence film 14, with the convex lens of the micro lens array 17 which consists of a member with a high refractive index, the light aslant emitted to the 11th page of the substrate is also perpendicularly refracted to the 11th page of a substrate, and is emitted to the exterior of a device. therefore, the light emitted from the organic electroluminescence film 14 -- almost -- all (for example, not less than 95%) -- you can make it emitted out of the organic electroluminescence device 1, and the light can be made to reach to a naked eye

[0040]

On the other hand, in the conventional organic electroluminescence device shown in drawing 8, since it does not have the micro lens array, the light aslant emitted from the organic electroluminescence films 84 and 94 will be reflected on the boundary of the substrate 81 and exterior air, or the protective film 96 of an organic electroluminescence device and the boundary of exterior air. Thereby, in the conventional organic electroluminescence device, the light emitted out of an organic electroluminescence device among the lights emitted from the organic electroluminescence film will be 30 to about 40%.

Therefore, the organic electroluminescence device 1 of this embodiment can increase the brightness of a screen about 2.5 times, making conditions, such as power consumption, the same compared with the conventional organic electroluminescence device.

[0041]

Next, the manufacturing method of the organic electroluminescence device 1 of this embodiment is explained with reference to drawing 2. Drawing 2 is an outline sectional view showing each manufacturing process of the organic electroluminescence device 1. First, as shown in drawing 2 (a), a closure board luminescence type organic electroluminescence board is prepared. This organic electroluminescence board forms the negative pole 13, the organic electroluminescence film 14, the anode 15, and the protective film 16 on the substrate 11 in which the transistor 12 was formed. The protective film 16 is a member for intercepting that oxygen or moisture in the air contacts an organic EL device. It is preferred to use an oxidization nitriding silicone film ($S_iN_xO_y$) as the protective film 16. It is because an oxidization

nitriding silicone film has the high transmissivity of light and it excels in the interception nature of moisture and oxygen as the Reason.

[0042]

Subsequently, the resin 17' which has a high refractive index on the protective film 16 is applied. What has optical hardenability as the resin 17' is preferred. Tg point of the organic electroluminescence film 14 which constitutes the organic EL device is before and after 100-degree Centigrade, and since the Reason is extremely low compared with the cure temperature of heat hardening type resin, it is because the heat hardening type resin cannot be hardened.

[0043]

Subsequently, as shown in drawing 2 (b), the model 31 of a micro lens array is prepared, and the field where the resin 17' is applied, and the model 31 of a micro lens array are stuck so that air bubbles may not mix in the resin 17' etc.

[0044]

As for the model 31 of a micro lens array, forming by a quartz board is preferred. For example, the Au/Cr film which is glass-proof etching mask membrane is formed to quartz, the opening of a hole or the slot is carried out to the prescribed position in the Au/Cr film, and only predetermined time performs glass etching from the portion. If it does so, the concave lens which consists of a minute crevice will be formed. The curvature radius of this concave lens is controllable by etching time. The film which serves for Teflon (registered trademark) etc. to get wet in the surface of the model 31 of a micro lens array, to lower a sex to it, and to lower the adhesion nature of high refractive-index resin is formed.

[0045]

Aligning so that the center which is a pixel which the optic axis and the organic electroluminescence film 14 of each lens in the model 31 of a micro lens array make may be in agreement, it irradiates with light from the model 31 side of a micro lens array, and the resin 17' is stiffened.

[0046]

Finally, as shown in drawing 2 (c), it removes from the resin 17' which hardened the model 31 of the micro lens array. Since the film which the above gets wet and lowers a sex at this time is formed at the model 31 of the micro lens array, that peel-off can be performed very easily. Thus, even if it drives the manufactured organic electroluminescence device 1 by the low voltage, it is bright, and a life is extended the about twice of the conventional organic electroluminescence device.

[0047]

(A 2nd embodiment)

Next, the organic electroluminescence device concerning a 2nd embodiment of this invention

is explained. Drawing 3 is an outline sectional view showing the organic electroluminescence device concerning a 2nd embodiment of this invention. This organic electroluminescence device 2 is a substrate side luminescence type organic electroluminescence device using the light which made light emit from the bottom side of the substrate 21, namely, penetrated the substrate 21.

[0048]

This organic electroluminescence device 2 is provided with the following.

The transparent substrate 21.

The transparent anode (ITO) 25 provided on the substrate 21.

The organic electroluminescence film 24 provided on the anode 25.

The negative pole 23 provided on the organic electroluminescence film 24.

As for the organic electroluminescence film 24, it is preferred to comprise a luminous layer (organic electroluminescence layer) and an electron hole transportation layer. And the organic EL device consists of the anode 25, the organic electroluminescence film 24, and the negative pole 23. It is divided with the partition (bank) 28, and two or more anodes 25 and organic electroluminescence films 24 are formed on the substrate 21, and are making the pixel, respectively. The transistor 22 which drives an organic EL device actively is formed in the substrate 21.

[0049]

In this organic electroluminescence device 2, the micro lens array 27 is formed in the inside of the substrate 21. And each lens of the micro lens array 27 is arranged at every [of an organic EL device] pixel (the anode 25 and organic electroluminescence film 24). Arrangement with each lens of this micro lens array 27 and the pixel of an organic EL device is good also as that by which the pixel of one organic EL device is arranged for two or more lenses of every which can be set not only to the composition shown in drawing 2 but to the micro lens array 27. It is good also as that by which the pixel of two or more organic EL devices is arranged for every lens in the micro lens array 27.

[0050]

The microphone lens array 27 comprises two or more Fresnel's lenses arranged for every pixel. The interlayer insulation film (S_iO_2) 29 is formed and the circumference of this Fresnel's lens is made flat with this interlayer insulation film 29. And the above-mentioned organic EL device is formed in the upper surface of the interlayer insulation film 29.

[0051]

By these, this organic electroluminescence device 2 is the light emitted from the organic electroluminescence film 24, and the light which saw from the organic electroluminescence film 24 and was emitted to the substrate 21 side emits it to the exterior of the organic electroluminescence device 2, after penetrating the anode 25, the micro lens array 27, and the

substrate 21.
Here, among the lights emitted from the organic electroluminescence film 24, by the micro lens array 27 which consists of a member with a high refractive index, the light aslant emitted to the 21st page of the substrate is also perpendicularly refracted to the 21st page of a substrate, and is emitted to the exterior of a device. therefore, the light emitted from the organic electroluminescence film 24 like the organic electroluminescence device 1 of a 1st embodiment -- almost -- all (for example, not less than 95%) -- you can make it emitted out of the organic electroluminescence device 2, and the light can be made to reach to a naked eye
[0052]
Next, the manufacturing method of the organic electroluminescence device 2 of this embodiment is explained with reference to drawing 4 thru/or drawing 6. As an outline of the manufacturing method of the organic electroluminescence device 2, first, form the micro lens array 27 in the inside of the substrate 21, and it ranks second to it, The active-matrix circuits (the transistor 22, wiring, etc.) which drive an organic EL device are formed on the micro lens array 27, it ranks second and an organic EL device is formed on an active-matrix circuit.
[0053]
Therefore, since the lens which can bear this temperature (about 500-degree Centigrade) in the process of the low-temperature polycrystalline silicon TFT must be formed, it is necessary to form micro lens array 27 the very thing at the charge of non-equipments.
When forming at the charge of non-equipments constitutes the difficult micro lens array 27 from this organic electroluminescence device 2 as Fresnel's lens, it can manufacture easily using thin film formation art. For this reason, it can develop easily also in the process of the low-temperature polycrystalline silicon TFT, and clear-izing of a picture, low-power-consumption-izing, and reinforcement can be attained.
[0054]
Next, the concrete manufacturing method of the organic electroluminescence device 2 using the low-temperature polycrystalline silicon TFT board which built in the micro lens array 27 which consists of Fresnel's lenses is explained. Drawing 4 and drawing 5 are the outline sectional views showing each manufacturing process of the organic electroluminescence device 2.
[0055]
First, as shown in drawing 4 (a), the oxidization nitriding silicone film 41 used as the component of Fresnel's lens is formed in the substrate 21 which is a glass substrate. For example using the plasma CVD, this oxidization nitriding silicone film 41 is formed so that it may become 2.0-micrometer film thickness.
[0056]
The relation between the number ratio of atoms of nitrogen and oxygen at the time of formation

of this oxidization nitriding silicone film 41 and transmissivity and the relation between the number ratio of atoms of nitrogen and oxygen and a refractive index are shown in drawing 6. It is desirable for the composition ratio of nitrogen and oxygen to be 40% to 80% about oxygen in an atomic percentage ratio by drawing 6. As the Reason, [the oxygen concentration beyond this] It is because transmissivity will fall rapidly if a refractive index becomes low, and performance of a micro lens array cannot be demonstrated and oxygen concentration is lowered more, so it will be a dark organic electroluminescence device which does not let the light emitted from the organic electroluminescence film 24 pass.

[0057]

Subsequently, as shown in drawing 4 (b), in order to form Fresnel's lens, 1st patterning and etching are performed about the oxidization nitriding silicone film 41 provided in the substrate 21. For example, patterning is performed using photolithographic technique, oxygen is mixed with CF system gas and etching is performed using parallel monotonous type reactivity ion etching equipment.

[0058]

Subsequently, as shown in drawing 4 (c), in order to form Fresnel's lens, 2nd patterning and etching are performed about the oxidization nitriding silicone film 41 provided in the substrate 21. This 2nd patterning performs [like the 1st time] about 1.0-micrometer etching using parallel monotonous type reactivity ion etching equipment using the same CF system gas as the 1st etching, and the gas which mixed oxygen by the 2nd etching using photo lithography. Thereby, the micro lens array 27 by Fresnel's lens is completed. Here, patterning and etching beyond the 3rd time and the 4th it may be repeated, and highly precise Fresnel's lens may be formed.

[0059]

Subsequently, as shown in drawing 4 (d), about the substrate 21 in which the micro lens array 27 was formed, by performing an application and calcination of a spin-on glass, the interlayer insulation film 29 is formed and the surface of the micro lens array 27 is made flat. Flat-izing by polish by membrane formation and CMP of the oxidization silicone film by the plasma CVD or flat-izing by the etchback of a registry of this flat-izing is also good.

[0060]

Subsequently, as shown in drawing 4 (f), formation of the transistor 22 by the low-temperature polycrystalline silicon TFT, formation of the anode 25 by an indium tin oxide (ITO:Indium Tin Oxide), the gate line 51, the power source wire 52, etc. are formed, and a TFT board is completed.

[0061]

Subsequently, as shown in drawing 4 (g), the interlayer insulation film (S_iO_2) 53 is formed with the plasma CVD on the substrate 21, and the interlayer insulation film of the place which

should form a pixel is removed by photo lithography and dry etching.
Subsequently, as shown in drawing 5 (h), the partition (bank) 28 is formed in the boundary part of the field which should form each pixel with resin.

[0062]
Subsequently, as shown in drawing 5 (i), the electron hole transportation layer 24a and the luminous layer (EL layer) 24b which make the organic electroluminescence film 24 are formed in each pixel field divided with the partition 28. As for this electron hole transportation layer 24a and luminous layer 24b, forming using a drop discharge method is preferred. PEDOT of the component of the electron hole transportation layer 24a is dropped at each pixel field from the head of an ink-jet printer, after making it dry, it is making the material used as the luminous layer of RGB which is the three primary colors dropped at a request position from the head of an ink-jet printer, and, specifically, an organic EL device is formed.

[0063]
Finally, the vacuum deposition of the aluminum 23 is made to carry out to calcium by film thickness (1 nm and 200 nm) above the organic electroluminescence film 24, respectively, it ranks second to it, and the glass which carried out Zagury processing of the drawing display portion is pasted up in a nitrogen atmosphere. Thereby, the organic electroluminescence device 2 of this embodiment is completed.

[0064]
By these, [the organic electroluminescence device 2 of this embodiment] Since the micro lens array 27 which consists of Fresnel's lens provided directly under the organic EL devices (organic electroluminescence film 24 etc.) which are light emitting elements condenses the light emitted from the organic electroluminescence film 24, It becomes possible to adjust the angle which the light in case the condensed light penetrates the transparent substrate 21 and is emitted to the exterior, and the field of the substrate 21 make to the angle which does not carry out total internal reflection.

[0065]
Therefore, this organic electroluminescence device 2 can be made to be able to emit to the exterior of the organic electroluminescence device 2, and can be made to reach man's eyes about most lights which carried out total internal reflection in the conventional organic electroluminescence device as shown in drawing 8 on the boundary of the substrate 81 and air, or the boundary of the protective film 96 and air, and were not emitted outside. Therefore, the organic electroluminescence device 2 becomes possible [enabling it for it to become possible to make man's eyes reach, and for efficiency to be very high and to express about 67% of the light emitted from the organic electroluminescence film 24 to high-intensity as the low voltage, and also reducing power consumption sharply]. And since power consumption becomes very small, the degradation speed of an organic EL device is also stopped and the

organic electroluminescence device 2 becomes possible [lengthening a product life sharply].
[0066]
If the example of an experiment is given, when luminosity will manufacture the organic electroluminescence device of 100 [Cd/m^2], Although what is necessary is just to make the voltage of about 3.0 [V]s impress as luminescence voltage (drive voltage) of an organic EL device with the organic electroluminescence device 2 of this embodiment, with the conventional organic electroluminescence device as shown in drawing 8, the voltage of about 5 [V]s is needed as luminescence voltage. In the case of the above-mentioned manufacturing conditions, with the conventional organic electroluminescence device, the life was about 10,000 hours to there being about 30,000 hours or more of lives with the organic electroluminescence device 2.
[0067]
It was proved that the organic electroluminescence device 2 of this embodiment could realize the formation of a low-voltage drive and low-power-consumption-izing which become very important in mobile computing devices [the conventional organic electroluminescence device] by these.
[0068]
(A 3rd embodiment)
Next, the organic electroluminescence device concerning a 3rd embodiment of this invention and its manufacturing method are explained. Drawing 7 is an outline sectional view showing the organic electroluminescence device concerning a 3rd embodiment of this invention, and its manufacturing method. The outline of this organic electroluminescence device pastes up the micro lens array 17 on the organic electroluminescence device created with the conventional manufacturing method. The details of this manufacturing method are explained below.
[0069]
First, as shown in drawing 7 (a), the substrate side luminescence type organic electroluminescence device made to emit light from the bottom side of the transparent substrate 71 is manufactured. This organic electroluminescence device can be manufactured with the conventional manufacturing method. Therefore, this organic electroluminescence device is provided with the following.
The transparent substrate 71.
The transparent anode (ITO) 73 provided on the substrate 71.
The organic electroluminescence film provided on the anode 73.
The negative pole 76 provided on the organic electroluminescence film.
The organic electroluminescence film comprises the luminous layer (organic electroluminescence layer) 75 and the electron hole transportation layer 74, and constitutes the organic EL device from the anode 73, an organic electroluminescence film, and the

negative pole 76. It is divided with a partition (bank), and two or more anodes 73 and organic electroluminescence films are provided on the substrate 71, and are making the pixel, respectively. The transistor 72 which drives an organic EL device actively is formed in the substrate 71.

[0070]

Subsequently, the dotted line portion of the Drawings of the substrate 71 is deleted by polish, and the substrate 71 is made thin.

For example, the substrate 71 is made thin until thickness is set to 100 micrometers.

Subsequently, as shown in drawing 7 (b), the micro lens array 31' is pasted up on the bottom of the substrate 71 so that a lens may be arranged for every pixel which an organic EL device makes. Adhesion of this micro lens array 31' is performed using the resin 17' which is optical hardenability and has a high refractive index. The micro lens array 31' forms two or more concave lenses with the glass etc. which are the same material as the substrate 71. For example, the Au/Cr film which is glass-proof etching mask membrane is formed to quartz, the opening of a hole or the slot is carried out to the prescribed position in the Au/Cr film, and only predetermined time performs glass etching from the portion. If it does so, the concave lens which consists of a minute crevice will be formed, and the micro lens array 31' will be done.

The organic electroluminescence device of this embodiment is manufactured by these.

[0071]

By these, [the organic electroluminescence device of this embodiment] Since it can manufacture by adding small 2 processes of becoming a manufacturing process of the conventional organic electroluminescence device from polish of the substrate 71, and adhesion of the micro lens array 31', according to the manufacturing method of this embodiment, an organic electroluminescence device with optical high extraction efficiency can be manufactured very much at low cost.

[0072]

Drawing 9 is a circuit diagram showing an example at the time of applying the organic electroluminescence device (electrooptics device) concerning this embodiment to an active matrix type display device.

[0073]

As shown in drawing 9, on a substrate this organic electroluminescence device S1 Two or more scanning lines 131, Two or more signal wires 132 prolonged in the direction which crosses to these scanning lines 131, and two or more common electric supply lines 133 prolonged in parallel with these signal wires 132 are what was wired, respectively, The pixel (pixel field matter) AR is provided and constituted for every intersection of the scanning line 131 and the signal wire 132.

[0074]

To the signal wire 132, the data line drive circuit 390 provided with a shift register, level shifter, a video line, and an analog switch is formed.
On the other hand, to the scanning line 131, the scanning line drive circuit 380 provided with a shift register and level shifter is formed. The 1st transistor 322 by which a scanning signal is supplied to each of the pixel field AR via the scanning line 131 at a gate electrode, The retention volume cap holding the picture signal supplied from the signal wire 132 via this 1st transistor 322, The 2nd transistor 324 by which the picture signal held with the retention volume cap is supplied to a gate electrode, The light-emitting part (luminous layer) 360 put between the picture electrode 323 in which driving current flows in from the common electric supply line 133 when it electrically connects with the common electric supply line 133 via this 2nd transistor 324, and this picture electrode (anode) 323 and the opposite electrode (negative pole) 222 is formed.
[0075]
If the scanning line 131 drives on the basis of such composition and the 1st transistor 322 is set to ON at it, the potential of the signal wire 132 at that time will be held at the retention volume cap, and the switch-on of the 2nd transistor 324 will be decided according to the state of this retention volume cap. And when current flows into the picture electrode 323 from the common electric supply line 133 via the channel of the 2nd transistor 324 and also current flows into the opposite electrode 222 through the luminous layer 360, the luminous layer 360 comes to emit light according to the current amount which flows through this.
[0076]
(Electronic equipment)
The example of electronic equipment provided with the electrooptics device (organic electroluminescence device) of the above-mentioned embodiment is explained.
Drawing 10 is a perspective view showing an example of a cellular phone. In drawing 10, the numerals 1000 show the main part of a cellular phone, and the numerals 1001 show the indicator using an above organic electroluminescence device.
[0077]
Drawing 11 is a perspective view showing an example of wrist watch type electronic equipment. In drawing 11, the numerals 1100 show the main part of a clock, and the numerals 1101 show the indicator using an above organic electroluminescence device.
[0078]
Drawing 12 is a perspective view showing an example of portable information processors, such as a word processor and a personal computer. In drawing 12, the indicator for which the numerals 1200 used the information processor for and the numerals 1202 used the organic electroluminescence device of the above [input parts, such as a keyboard, and the numerals 1204 / the main part of an information processor and the numerals 1206] is shown.

[0079]
Since it has the organic electroluminescence device of the above-mentioned embodiment, the electronic equipment shown in drawing 12 from drawing 10 can be provided with the displaying means of the high efficiency of the light emitted from the organic EL device which can almost use all, and even if it does not send excessive current through an organic EL device, it can give a bright high indication of luminosity. Therefore, this electronic equipment operates with low consumption current, and becomes what has it. [long-life and inexpensive]
[0080]
Technical scope of this invention is not limited to the above-mentioned embodiment, and it is possible to add various change in the range which does not deviate from the meaning of this invention, and a concrete material, layer composition, etc. quoted by the embodiment are only a mere example, and can be changed suitably.
[0081]
For example, Lighting Sub-Division using an organic EL device, etc. may apply this invention to the display body (photogen) panel which needs especially luminosity.
This invention may be applied to mobile computing devices other than the above-mentioned embodiment. Driving with low power consumption is suitable for this invention on the electronic equipment which will be the requisite.
[0082]
The manufacturing method of the above-mentioned embodiment can be applied and the organic electroluminescence device in which a colored presentation is possible can also be constituted. What is necessary is just to change the curvature of each lens of the micro lens array which is made into the blue, green, and red who make the three primary colors as a manufacturing method of this color organic electroluminescence device, for example and which is arranged by corresponding for every pixel. What is necessary is just to adjust predetermined time for glass etching as an adjustment method of the curvature of each of this lens in the manufacturing method of a concave lens explained by a 3rd embodiment of the above for every lens corresponding for every pixel made into blue, green, and red. If etching time of Tg and a red pixel is set [the etching time of a blue pixel] to Tr for the etching time of Tb and a green pixel as a ratio of the glass etching time,
$Tb>Tg>Tr$ It carries out. The concave lens to which a size becomes small is formed in the order of blue, green, and red by this, and the organic electroluminescence device which is efficient and can display all the colors can be constituted.
When forming a micro lens array, etching may use not only wet etching but dry etching.
[0083]
[Effect of the Invention]
Since the micro lens array was provided in the light-emitting surface side of an organic

electroluminescence element by the above explanation according to this invention so that clearly, the light emitted from the organic EL device can be used efficiently.

[Brief Description of the Drawings]

[Drawing 1]It is an outline sectional view showing the organic electroluminescence device concerning a 1st embodiment of this invention.

[Drawing 2]It is an outline sectional view showing each manufacturing process of an organic electroluminescence device same as the above.

[Drawing 3]It is an outline sectional view showing the organic electroluminescence device concerning a 2nd embodiment of this invention.

[Drawing 4]It is an outline sectional view showing each manufacturing process of an organic electroluminescence device same as the above.

[Drawing 5]It is an outline sectional view showing each manufacturing process of an organic electroluminescence device same as the above.

[Drawing 6]It is a figure showing the relation between the number ratio of atoms of nitrogen and oxygen at the time of formation of an oxidization nitriding silicone film, and transmissivity, and the relation between the number ratio of atoms of nitrogen and oxygen, and a refractive index.

[Drawing 7]It is an outline sectional view showing the organic electroluminescence device concerning a 3rd embodiment of this invention, and its manufacturing method.

[Drawing 8]It is an outline sectional view showing an example of the conventional organic electroluminescence device.

[Drawing 9]It is a circuit diagram showing an active-matrix type display device.

[Drawing 10]It is a figure showing an example of electronic equipment provided with the electrooptics device of this embodiment.

[Drawing 11]It is a figure showing an example of electronic equipment provided with the electrooptics device of this embodiment.

[Drawing 12]It is a figure showing an example of electronic equipment provided with the electrooptics device of this embodiment.

[Explanations of letters or numerals]

1, 2 Organic electroluminescence device
11, 21 Substrate
12, 22 Transistor
13, 23 Negative pole
14, 24 Organic electroluminescence film
15, 25 Anode
16 Protective film
17, 27, a 31' micro lens array

17' Resin
28 Partition (bank)
29 Interlayer insulation film (S_iO_2)
41 Oxidization nitriding silicone film
51 Gate line
52 Power source wire
53 Interlayer insulation film
71 Substrate
72 Transistor
73 Anode
74 Electron hole transportation layer
75 Luminous layer (organic electroluminescence layer)
76 Negative pole

[Brief Description of the Drawings]
[Drawing 1]It is an outline sectional view showing the organic electroluminescence device concerning a 1st embodiment of this invention.
[Drawing 2]It is an outline sectional view showing each manufacturing process of an organic electroluminescence device same as the above.
[Drawing 3]It is an outline sectional view showing the organic electroluminescence device concerning a 2nd embodiment of this invention.
[Drawing 4]It is an outline sectional view showing each manufacturing process of an organic electroluminescence device same as the above.
[Drawing 5]It is an outline sectional view showing each manufacturing process of an organic electroluminescence device same as the above.
[Drawing 6]It is a figure showing the relation between the number ratio of atoms of nitrogen and oxygen at the time of formation of an oxidization nitriding silicone film, and transmissivity, and the relation between the number ratio of atoms of nitrogen and oxygen, and a refractive index.
[Drawing 7]It is an outline sectional view showing the organic electroluminescence device concerning a 3rd embodiment of this invention, and its manufacturing method.
[Drawing 8]It is an outline sectional view showing an example of the conventional organic electroluminescence device.
[Drawing 9]It is a circuit diagram showing an active-matrix type display device.
[Drawing 10]It is a figure showing an example of electronic equipment provided with the

electrooptics device of this embodiment.
[Drawing 11]It is a figure showing an example of electronic equipment provided with the electrooptics device of this embodiment.
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[Explanations of letters or numerals]
1, 2 Organic electroluminescence device
11, 21 Substrate
12, 22 Transistor
13, 23 Negative pole
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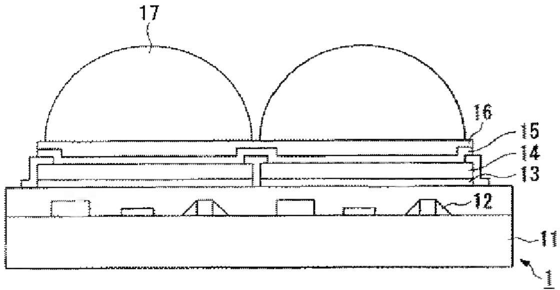
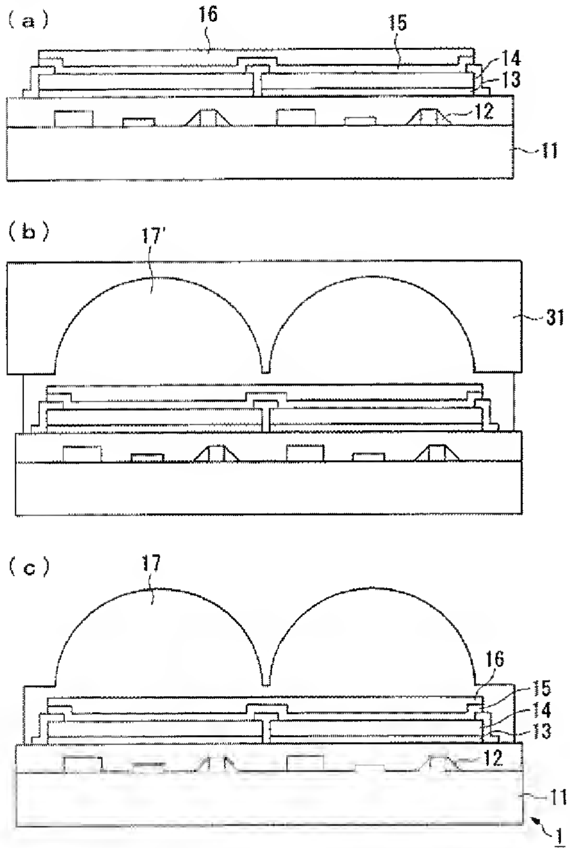
16 Protective film
17, 27, a 31' micro lens array
17' Resin
28 Partition (bank)
29 Interlayer insulation film (S_iO_2)
41 Oxidization nitriding silicone film
51 Gate line
52 Power source wire
53 Interlayer insulation film
71 Substrate
72 Transistor
73 Anode
74 Electron hole transportation layer
75 Luminous layer (organic electroluminescence layer)
76 The negative pole

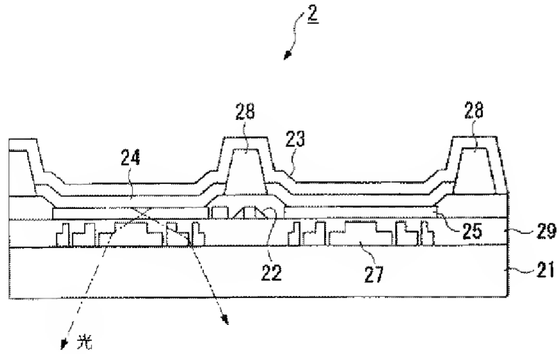
[Drawing 1]



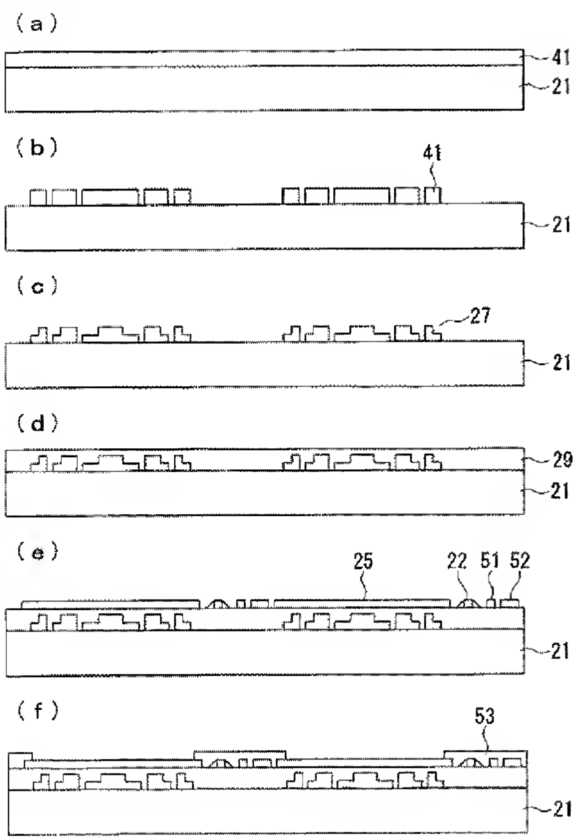
[Drawing 2]



[Drawing 3]

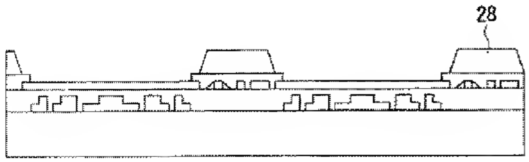


[Drawing 4]

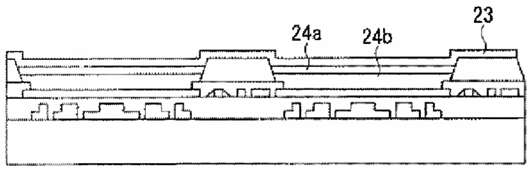


[Drawing 5]

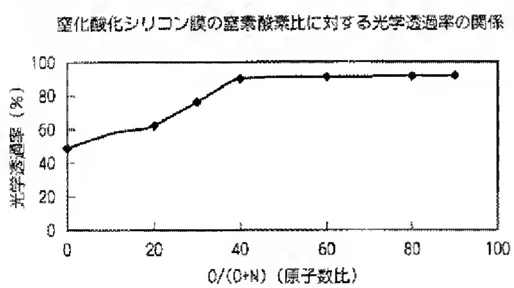
(g)

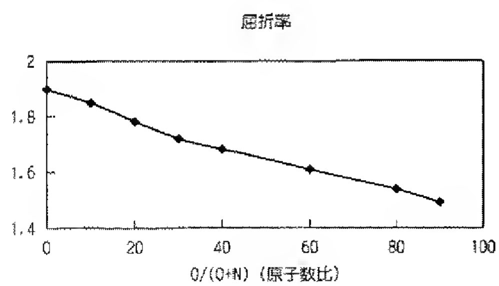


(h)



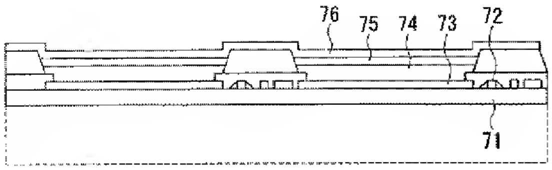
[Drawing 6]



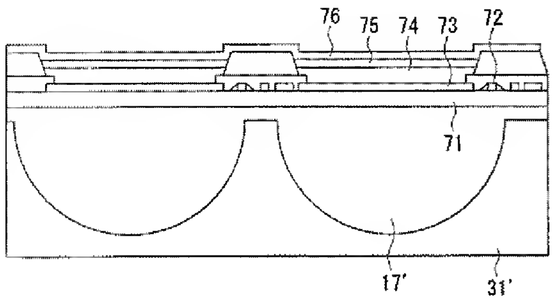


[Drawing 7]

(a)

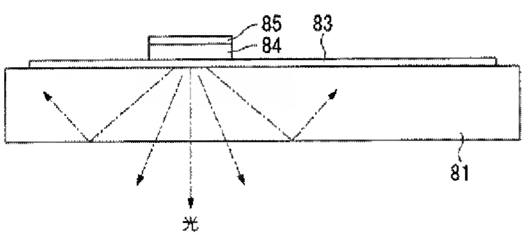


(b)

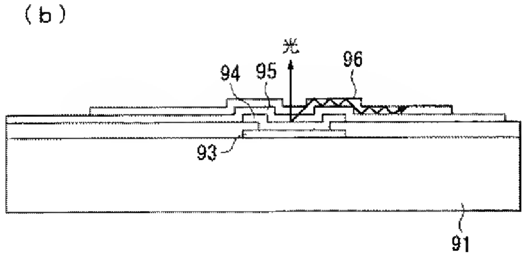


[Drawing 8]

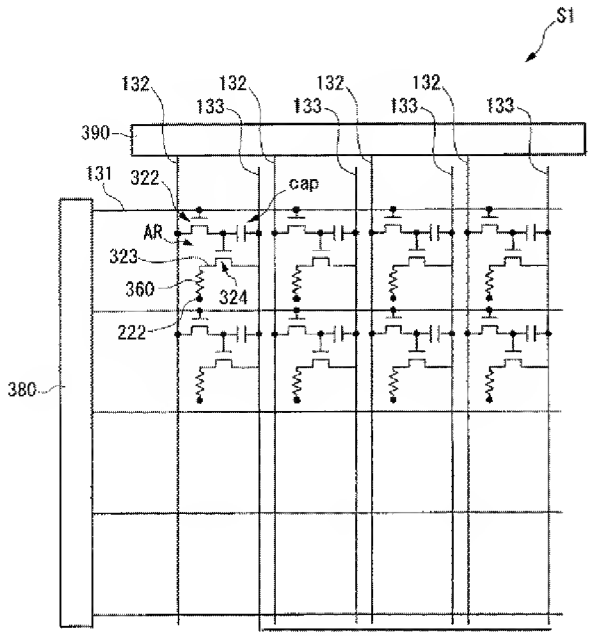
(a)



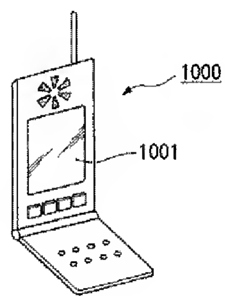
(b)



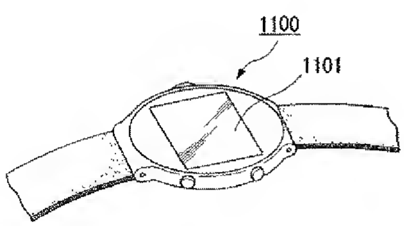
[Drawing 9]



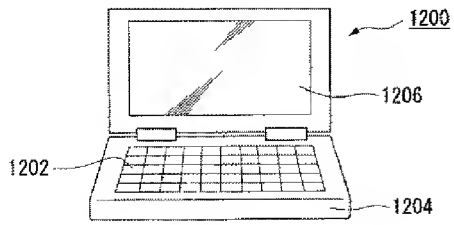
[Drawing 10]



[Drawing 11]



[Drawing 12]



[Translation done.]